Charging the polluters: A pricing model for road and railway noise

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- This study focus on the noise externality: "Travelers" likely to only consider the noise level inside the vehicle

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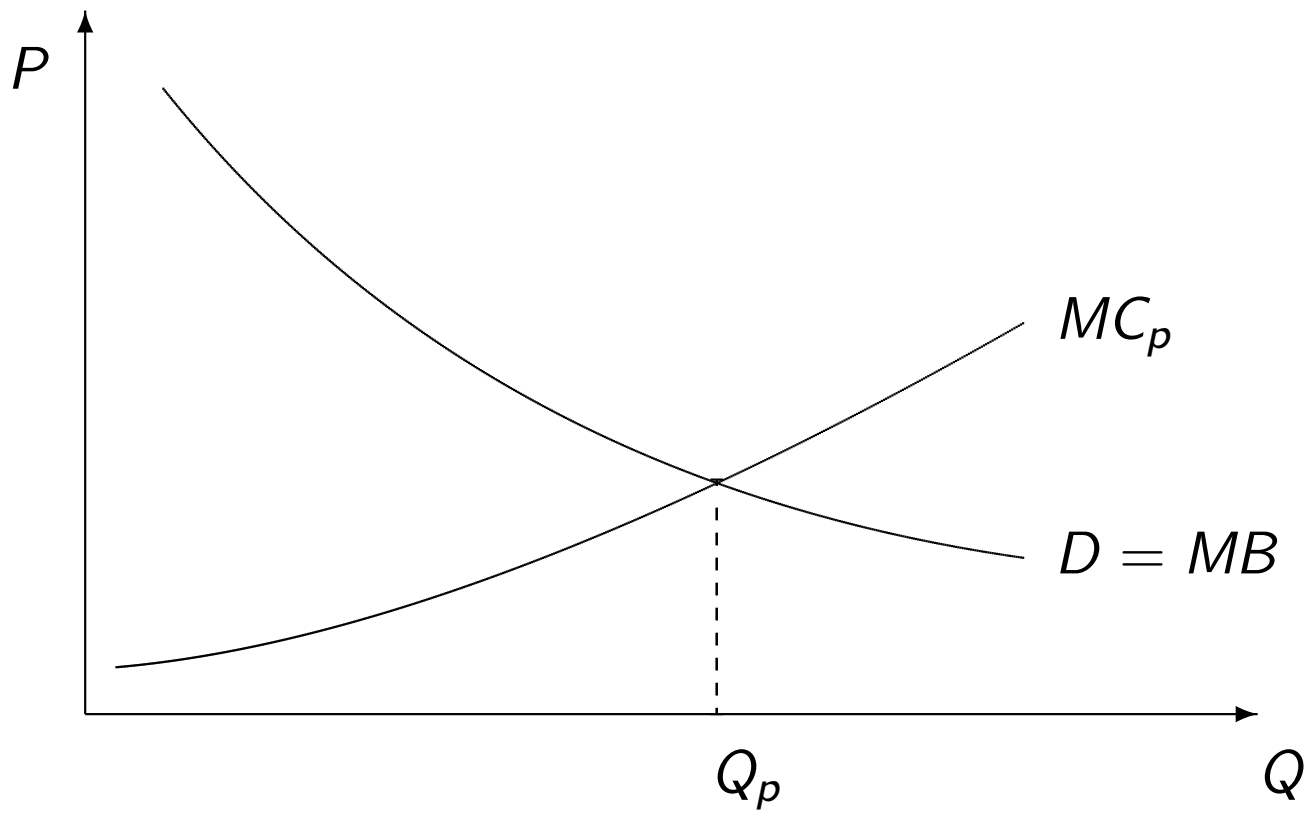
Marginal cost pricing and economic efficiency



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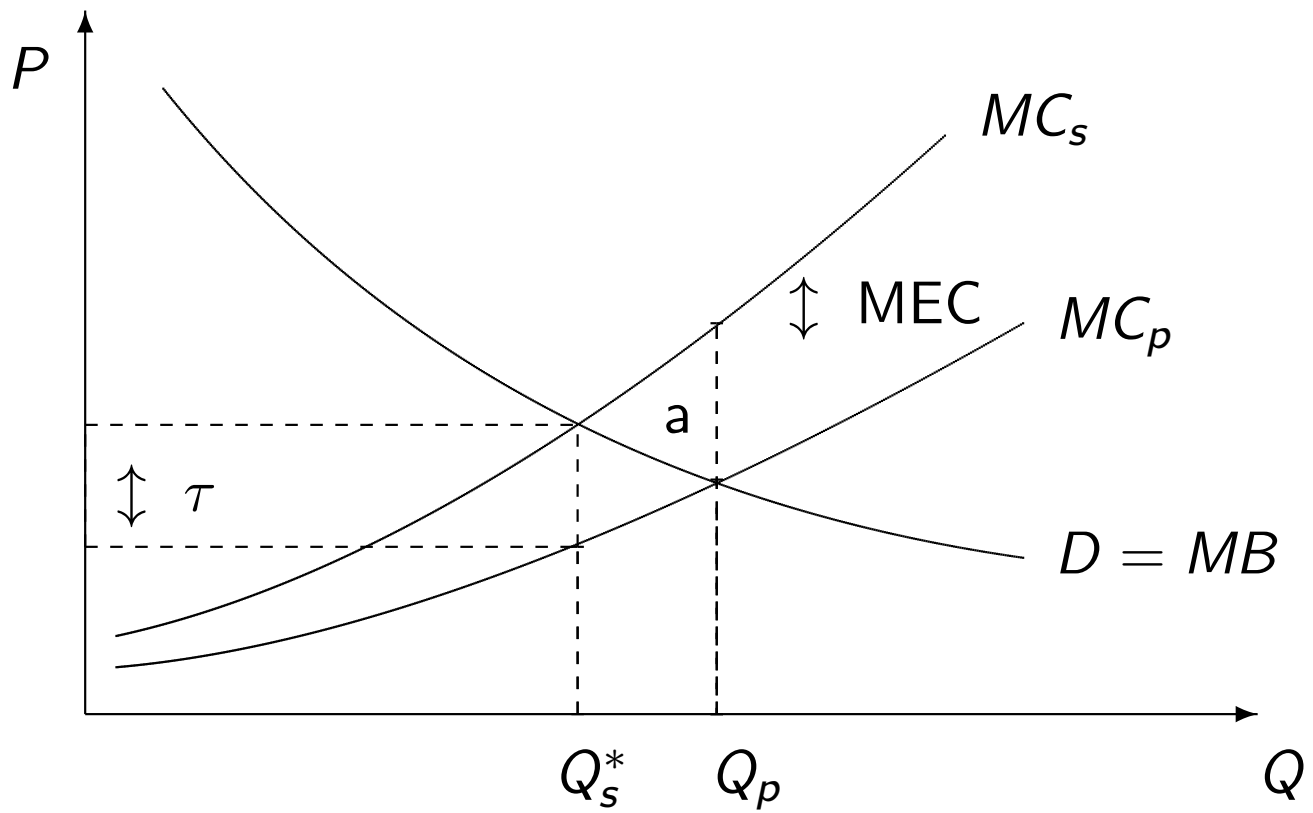

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$$T = \sum_L c(L(\cdot))N(L)\Delta L$$

$c(L(\cdot)) = \partial C(L(\cdot))/\partial L$
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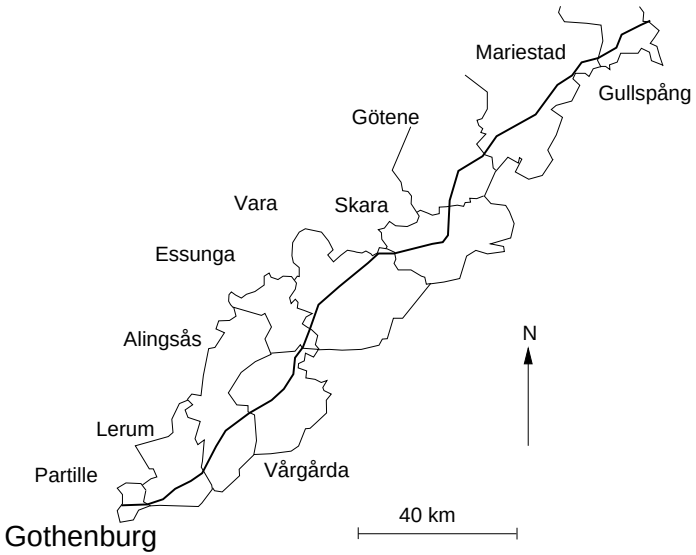
3. Marginal acoustical effect: ΔL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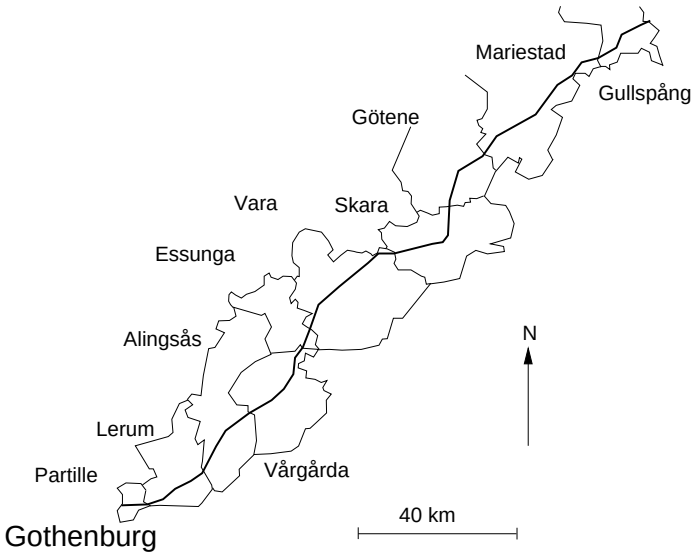
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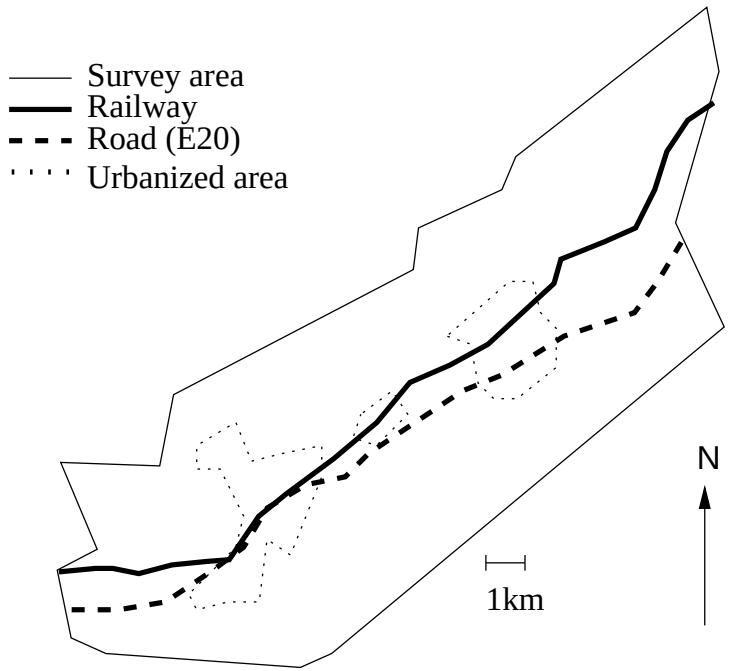
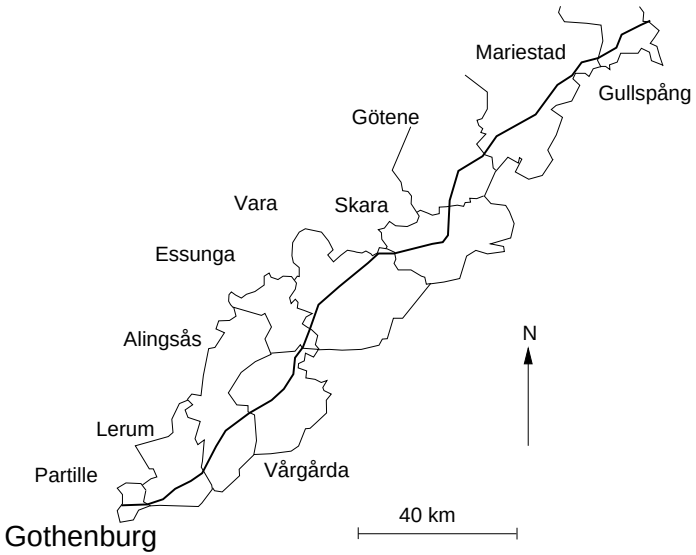

Survey area
Railway
Road (E20)
Urbanized area
N
1km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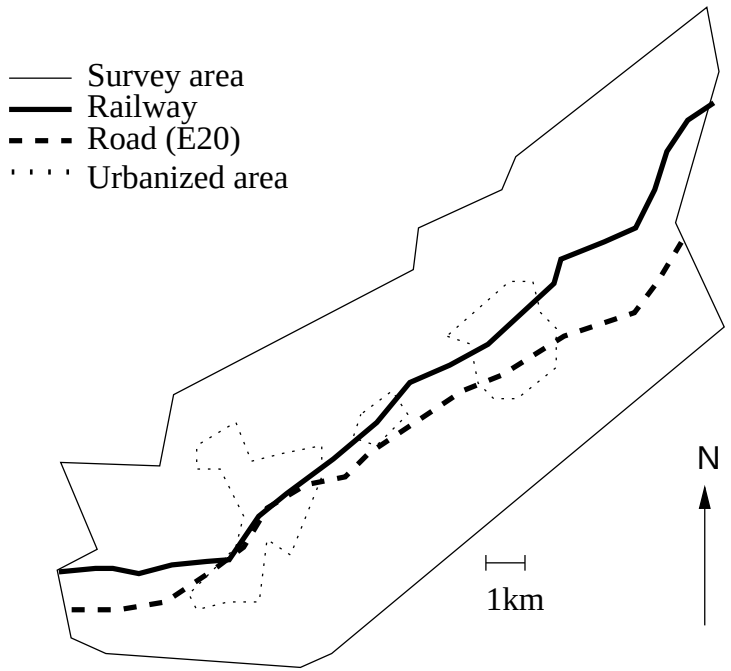
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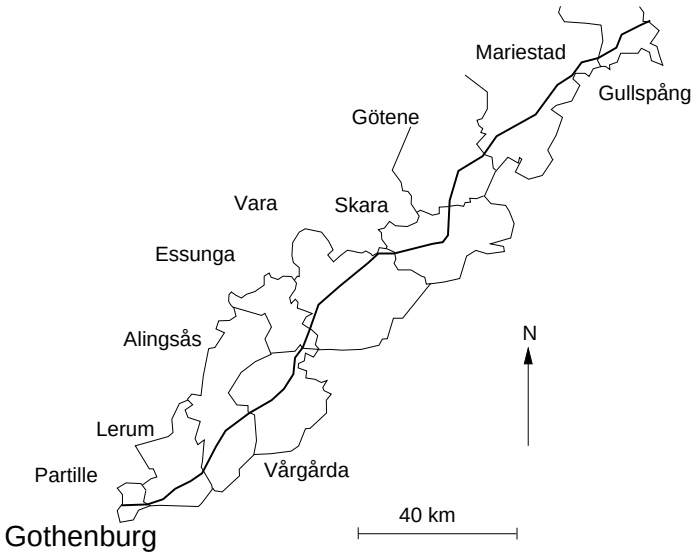

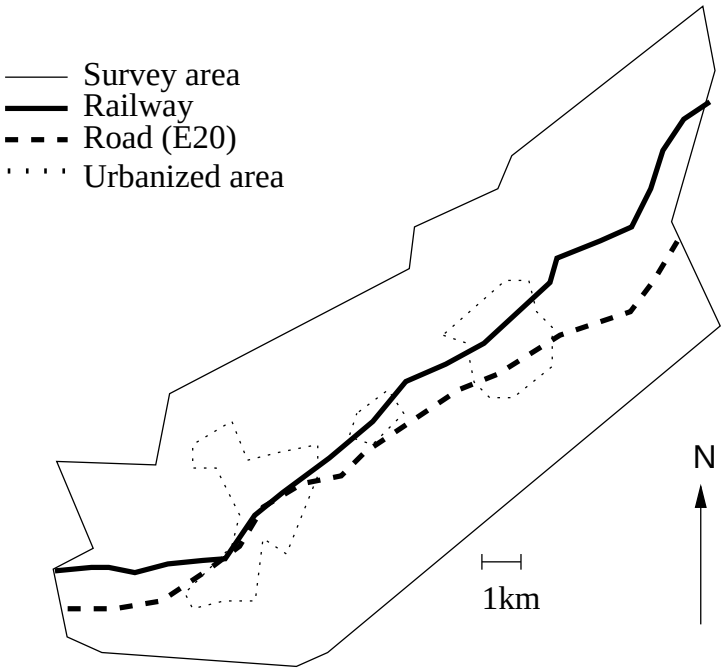

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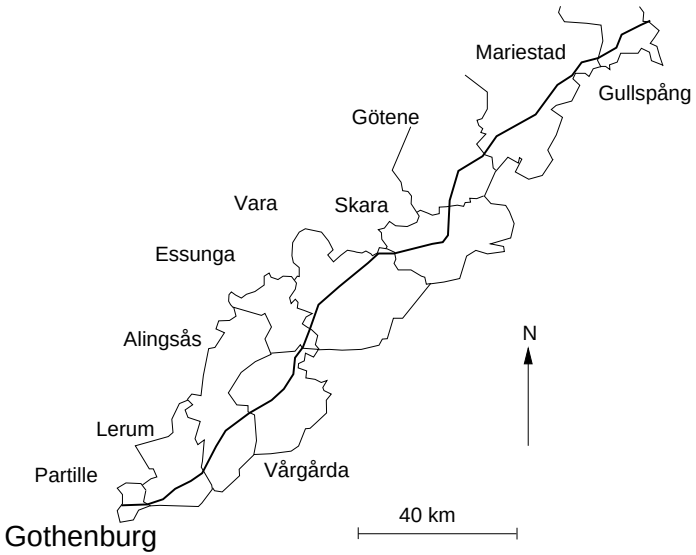

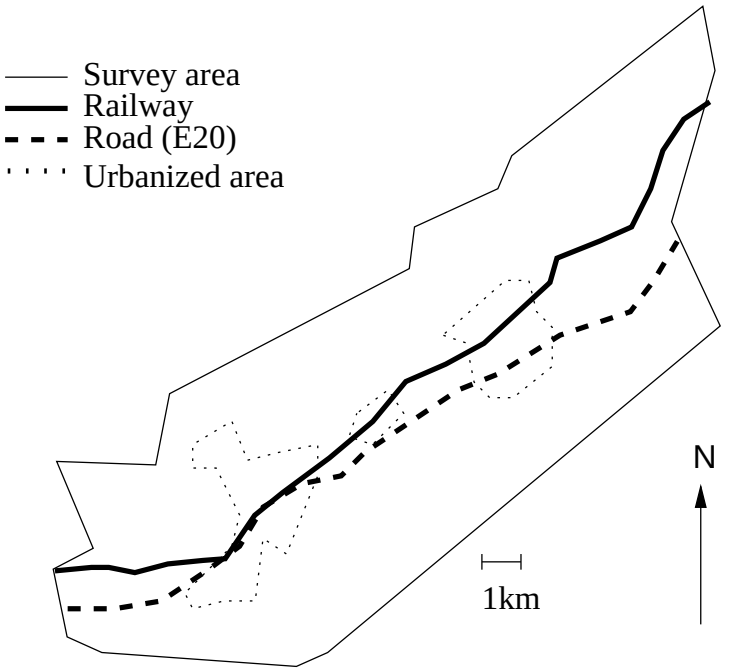

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Noise indicators and emitters

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- Quiet technology: Low-noise tires and retrofitting of breaks (from cast iron to K-blocks)

Marginal acoustical change

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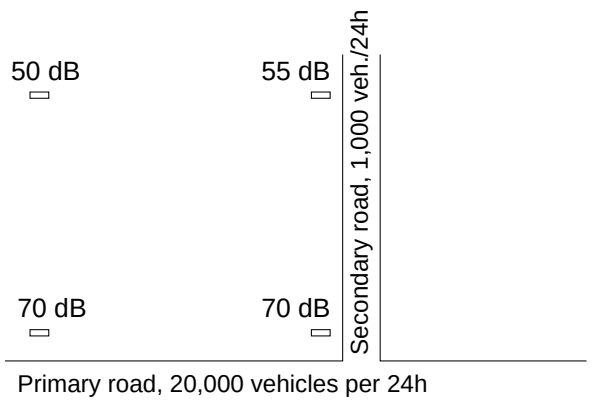

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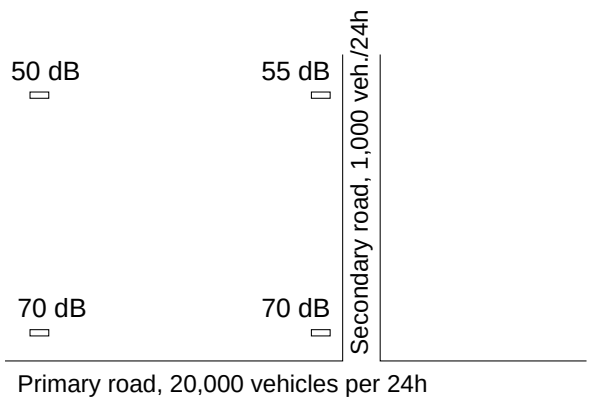

- Observation where secondary sources dominate regarding road noise have been omitted $\Rightarrow$ 10% have been removed

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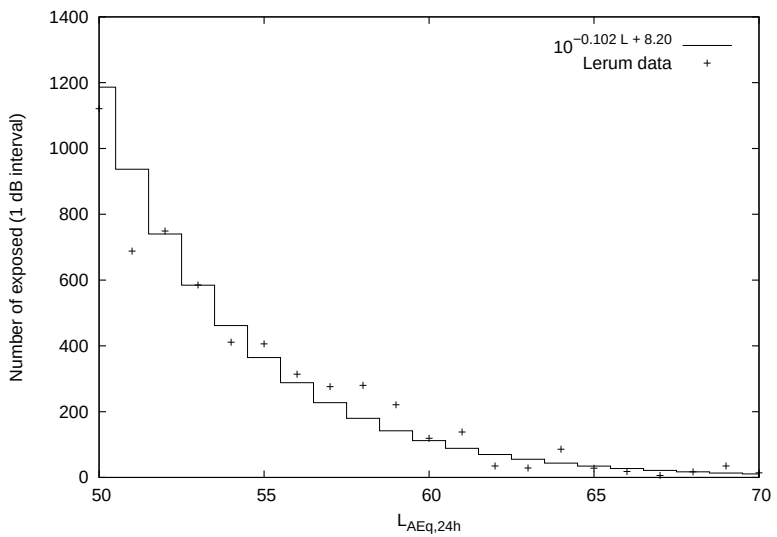

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	Change		**REBUS** w/o health	**REBUS** w/ health	**ASEK** (w/ health)
Road	56	55	363	437	258
	66	65	495	569	568
	75	74	654	729	3,343
Railway	56	55	24	98	NA
	66	65	308	382	NA
	75	74	3,027	3,101	NA

Average exchange rate 2004: EUR 1 = SEK 9.13

Noise tariffs calculated per vehicle and unit

Vehicle	Speed km/h	Passengers/ Freight[a]	Tariff, SEK/km per vehicle	Tariff, SEK/km per unit[b]
Passenger traffic				
Car	110	4	0.06	0.0148
Bus	90	50	0.24	0.0048
X2 high speed	135	310	0.37	0.0012
X14 EMU	135	350	0.29	0.0008
X60 EMU	135	370	0.07	0.0002
Freight traffic				
Truck	90	42	0.24	0.0057
Truck (low noise)	90	42	0.08	0.0018
Freight train	90	1500	2.82	0.0019
F. tr. (K-blocks)	90	1500	0.45	0.0003

SEK price level 2004.
a: Number of passenger and metric ton of freight, respectively.
b: Per passenger and metric ton for passenger and freight traffic, respectively.

Sensitivity analysis: Traffic and technology

SRMC of freight per metric ton relative to a reference case of no change

	Changes as percent and dB						
Parameter	-50% -1.8dB	-25% -1.0dB	-10% -0.4dB	±0 ±0	+10% +0.4dB	+25% +1.0dB	+50% +1.8dB
Total traffic volume							
Railway	0.988	0.994	0.997	1.000	1.003	1.006	1.011
Road	0.992	0.996	0.998	1.000	1.002	1.004	1.008
Noise level of vehicle							
Railway	0.668	0.801	0.910	1.000	1.099	1.248	1.494
Road	0.667	0.800	0.909	1.000	1.100	1.250	1.500
Noise level of fleet							
Railway	0.661	0.796	0.907	1.000	1.102	1.256	1.512
Road	0.661	0.796	0.907	1.000	1.102	1.256	1.512
Number of exposed							
Railway	0.667	0.800	0.909	1.000	1.100	1.250	1.500
Road	0.667	0.800	0.909	1.000	1.100	1.250	1.500

Railway and Road refers to a 1,500 and a 60 metric ton vehicle, respectively.

Sensitivity analysis: Monetary values

SRMC of freight per metric ton for binary changes relative to a reference case

Parameter	Ref.	Railway	Road
Including health comp.	1.00	1.87	1.11
Switch val. road/rail	1.00	8.28	0.12
ASEK 4[a] val.	1.00	7.51	0.91
ASEK 4[a] (5 dB rail bonus)	1.00	2.21	0.91

a: ASEK 4 refers to the official Swedish monetary noise values (SIKA, 2008).

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  - Based on traffic situation and "exposed" in Lerum

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  - threshold level chosen: Inhabitants within 50–55 dB interval accounted for 32% and 63% of total cost for railway and road (Andersson and Ögren, 2007, 2010)

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  - Sensitive to monetary values used
- Previous research have also shown that estimates are sensitive to:
  - threshold level chosen: Inhabitants within 50–55 dB interval accounted for 32% and 63% of total cost for railway and road (Andersson and Ögren, 2007, 2010)
  - discount rate chosen for estimating the monetary value (Andersson et al. 2010a)

Discussion II

- Estimates show, though, that:
  - Insensitive to changes in traffic volume
  - Sensitive to number of exposed
  - Sensitive to monetary values used
- Previous research have also shown that estimates are sensitive to:
  - threshold level chosen: Inhabitants within 50–55 dB interval accounted for 32% and 63% of total cost for railway and road (Andersson and Ögren, 2007, 2010)
  - discount rate chosen for estimating the monetary value (Andersson et al. 2010a)
- Important to examine the SRMC on both vehicle and passanger/ton of freight level

Discussion III

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  - Our model has the potential of reaching a higher level of acceptability
  - A more sophisticated model is also more costly $\Rightarrow$ BCA
- The next step? Noise maps are being created for "busy areas" in the EU, but rules of thumps for number of exposed necessary to implement a model like ours

Research in progress: Area classification